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MIT purchased a 95 GHz extended interaction oscillator (EIO) and power supply from CPI, Inc. The EIO was specified so that it generates about 1 kW of peak power, operates at up to 1% duty, and has a 2 GHz mechanical tuning range. This instrumentation significantly enhances the educational experience of those graduate students participating in the vacuum electronics MURI.

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Final Report

DURIP Instrumentation for Advanced Source Development at 95 GHz

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Project Summary

MIT proposed to acquire a W-Band (95 GHz) source for use as a driver for advanced amplifier research under the funded DURIP program. This instrumentation is critically needed for testing innovative amplifiers that are currently being fabricated and assembled at MIT. The DURIP equipment will be used as part of the Innovative Vacuum Electronics research program at MIT. MIT, as part of that consortium, is investigating novel high frequency amplifiers at W-Band, such as wide-band gyroamplifiers and devices using photonic bandgap structures. We are also developing quasi-optical antennas and mode transformers for use with these amplifiers.

MIT purchased a 95 GHz extended interaction oscillator (EIO) and power supply from CPI, Inc. The EIO was specified so that it generates about 1 kW of peak power, operates at up to 1% duty, and has a 2 GHz mechanical tuning range. This instrumentation significantly enhances the educational experience of those graduate students participating in the vacuum electronics MURI. As a driver, it allows students to investigate the gain of advanced amplifiers at high output powers. As part of a cold testing facility, it provides significantly enhanced dynamic range in measurements of microwave structures. This results in a better comparison with electromagnetic models. Finally, it allows us to train our students in the proper use of high power microwave instrumentation.

95 GHz EIO

Under the DURIP award, we purchased a pulsed extended interaction klystron amplifier from Communication & Power Industries (CPI), Inc. The model number is VKB244506 and the serial number is E0876B1. The EIO and power supply together constitute a transmitter. The transmitter is a model VPW3493-03, S/N002.

The EIO met specifications across the band. The measured results at the factory are listed in the Table.

Table: EIO Test Results

Test Frequency (GHz)	RF Output Power (W, Peak)
90.7	988
91.0	1250
92.0	1700
93.0	1830
93.5	1830
94.0	1630
94.5	1166
95.0	1560
95.7	2350

The Table results indicate that the EIO has put out the specified 1 kW of power over the entire band from 93.0 to 95.0 GHz. The output power was in fact substantial over a frequency bandwidth of 5 GHz, much larger than the specified 2 GHz bandwidth.

EIO Installation and Testing

After receipt at the MIT Plasma Science and Fusion Center, the EIO was set up for testing on a lab bench. The output power was measured with a power meter and found to agree with the powers listed in the Table above. To this date, October, 2001, the EIO has operated in a satisfactory manner with no problems. The EIO is therefore considered to be accepted as delivered. We intend to use the EIO as the driver in upcoming experiments at 95 GHz.